

Students' innovative and creative thinking skill profile in designing chemical batik after experiencing ethnoscience integrated science technology engineering mathematic integrated ethnoscience (ethno

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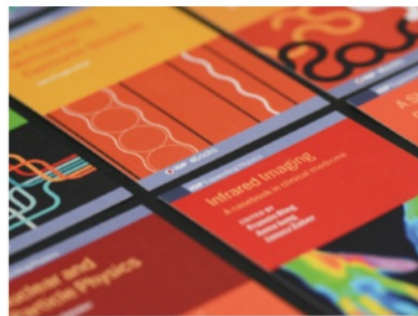
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3 Students' innovative and creative thinking skill profile in designing chemical batik after experiencing ethnoscience integrated science technology engineering mathematic integrated ethnoscience (ethno-stem) learnings

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Abstract. This research aims to measure the innovative and creative character of Chemistry students in batik motifing of Chemical structures after learning natural products with the integrated STEM approach Ethnoscience. This type of research is a qualitative descriptive study with students of Chemistry education at UNNES taking Natural Product courses as a subject. Instruments data collection are questionnaires, interviews, the value of chemical batik products, and creativity in describing the meaning of batik motifs, appearance, origin, and color creations that have been designed on canvas. Chemical batik products produced by Ethno-STEM Project study were assessed by a research team and batik experts from Zie Batik Malon Gunungpati and batik experts from Pekalongan to determine which batik motifs are feasible to be produced as a form of research downstreaming. The final result of the batik design was decided that four decent batik products were produced in terms of motifs, color display, originals, and interesting creativity according to the judgment of batik experts. The four innovative and creative batik motifs with high scores are the anti-Christian batik motif, alpha pinene, curcuminoid, and Etbo-STEM carotenoids. From the results of this study it was concluded that the profile of innovative and creative character of students after learning with the Etno-STEM approach is very good.

1. Introduction

UNNES 'vision is to become a university with a conservation and international reputation. To provide clear and measurable directions for achieving the vision and mission, the UNNES research strategic plan is focused on Leading research objectives on innovative learning to equip the character of conservation, international reputation and entrepreneurship [1-2]. This research will develop the character of creative and innovative thinking from students taking Natural Product Organic Chemistry courses with the Science Technology Engineering and Mathematics (STEM) integrated Ethnoscience (Ethno-STEM) Approach through a batik project to prepare to face the current industrial industry 4.0 era. Thus the Ethno-STEM approach developed was as an innovative learning in the 21st century [3].

This research is applied to the study of Natural Product Organic Chemistry, because in this course many local plants are discussed that contain thousands of secondary metabolite compounds that have unique and interesting structures as batik motifs. The purpose of this study is to downstream the research to produce (a) chemical batik motif design products with typical secondary metabolite structures as innovative and creative products for students after learning Natural Product with the



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Ethno-STEM approach, (b) determining the character profile of innovative and creative thinking college student; as well as student responses to learning Natural Product Organic Chemistry with project learning using the Ethno-STEM approach.

In this research Ethnoscience was chosen, because Indonesia is a country rich in various national cultures and one of the hereditary cultures in Indonesia is batik. In connection with batik, this research will make the making of batik motifs with the chemical structure of secondary metabolite compounds in an effort to develop the entrepreneurial character of students [4]. In this study takes the topic of Batik. In the process and production of batik contained chemical concepts, for example from the preparation of chemical tools batik material can not be separated from the field of chemical studies, the batik process also contained chemical concepts related to chemical reactions, changes in substances, and natural dyes. Thus batik is very closely related to natural product chemistry. In research to measure creative and innovative characters, students will be given project assignments in groups to design and produce secondary metabolite structure motifs, practice designing batik on canvas, present the results of batik designs in front of the class, communicate the philosophical meaning of batik motifs, and then the team researchers provide input for the improvement of batik products.

In the era of industrialization at this time, the important character of entrepreneurship is provided, and learning chemistry to develop entrepreneurial character has been done by Nancy [5]. This research focuses on creative and innovative thinking skills on students, because both skills are very important in dealing with the 21st century era, besides critical thinking, collaborative, problem solving skills, and Entrepreneur Characters [6-7]. Batik motifs as a result of the work and culture of the Indonesian nation at this time has been widely developed, but in this research will be designed and produced batik with a chemical structure motif of secondary metabolites. The developed batik motifs will explain from a minimum of two, three, or four components of STEM. In batik motifs, for example there are structures of certain metabolites, leaves or flowers that produce secondary metabolites, extraction tools are symbolized by erlenmeyer glass; and framed by certain mathematical structures, and the learning of natural products applied is project-based learning by Sudarmin et al [8]. Project-based learning integrated the STEM approach has been developed by Hans et al [9]. In the context of Natural Product learning, at the beginning of the lecture, several introductions were introduced regarding isolation techniques, phytochemical identification, structure testing, the number of secondary metabolite components in a plant, and some of the roles of flavonoids in biological systems [10-11].

The next discussion are some engineering examples of metabolite compounds, as well as calculation of the yield of secondary metabolite products. With reference to the learning achievements of Natural Product, in addition to cognitive competence / knowledge, the competency of skills and attitudes, then in this study designed a Natural Product learning model with integrated ethnics STEM approach. The STEM approach with integrated ethnics has never been done by a lecturer. This research is interesting, because the results of an analysis of Natural Product learning so far are known that learning still emphasizes conceptual knowledge, so factual, procedural knowledge, and developing the higher-order thinking skills needed in the 21st century have not yet been developed. The ethnoscience integrated STEM approach can achieve all the expected competencies [12-13]. This type of research is a qualitative descriptive study. The analysis of creative and innovative thinking skills after applying an innovative Natural Product learning model product with learning projek with the Etho-STEM approach to develop the character of creative and innovative thinking in making batik. The research subjects of students majoring in Chemistry UNNES take natural product subjects. In the process of producing chemical batik cloth, a collaboration with Natural Batik Zie is carried out in Deson Malon Gunungpati Semarang.

2. Methods

This research aims to determine the profile of innovative and creative thinking characters of students in designing chemical batik motif designs after applying the ethno-STEM integrated project learning model. Location of data collection at FMIPA UNNES and data related to the context of innovative and

creative characters in making batik motifs. The research instrument was in the form of observation sheets and questionnaires to reveal the profile of students' innovative and creative characters. Observation sheets are also used to assess various batik products on canvas with unique batik motifs with various chemical structures of secondary metabolites. Data collection was carried out when the Ethno-STEM integrated project learning model was applied and when assessing chemical batik products. Data were analyzed in qualitative descriptions, so that they could answer the problems that were formulated. Whereas aspects of innovative and creative characters are measured using the following N-gain equation.

$$N - gain = \frac{S_{posttest} - S_{pretest}}{S_{max} - S_{pretest}}$$

In this study, the high and low levels of innovative and creative characters refer to the price of N-gain. If you get the price of N-gain 0.7 including the high criterion, N-gain with $0.7 > N-gain > 0.3$ is the medium criterion, and N-gain < 0.3 includes the low criterion.

3. Discussion of Research Results

In the following sections, three batik motif products from the creativity and innovation of students that have been produced in the form of batik cloth and ready to be marketed are presented; the results are as follows.

3.1. *Produc Batik Ethno-STEM Kurkuminoid*

These batik motifs include machete striated batik designed and created with the aim to provide insight into the Natural Product Organic Chemistry compounds contained in native plants of Indonesia. The batik design is depicted in the form of a chemical structure formula (Figure 1). The compound used as a batik design is a bisdemetoksikurkumin compound contained in white Turmeric. White turmeric contains almost the same compound as yellow turmeric, namely curcuminoid which consists of curcumin, bisdemetoksi-kurkumin, and demetoksikurkumin compounds [14]. The selection of compounds is based on a variety of benefits provided as anti-inflammatory, antioxidant, antiviral, antibacterial, antifungal, and other positive effects on various diseases related to hepatoprotector. Other compounds displayed in batik designs are types of flavonoid compounds. Flavonoid compounds are a group of phenolic compounds that function as antioxidants and antibacterial [11]. The philosophy of selecting bisdemetoksikurkumin and flavonoid compounds is that both compounds have long chains and mean that unity and friendship must be maintained so that they are not easily broken. Both compounds also have benzene rings with conjugated double bonds which means that life as a human being must be consistent and have a characteristic that is a selling point in society. This batik motif is given an additional Etno-STEM ending which shows that this batik was created from the downstreaming of research related to the Innovative learning approach for Natural Product with the integrated Ethnoscience STEM approach (Ethno-STEM) as a learning model developed by Sudarmin [15].

This Ethno-STEM learning model has been registered with Intellectual Property rights as an innovative learning model for developing the character of conservation and Student Entrepreneurship. Besides displaying two secondary metabolite chemical compounds, batik designs also display floral motifs and line motifs that form a rectangle. Floral motifs give the impression of elegance and blend with nature, while line motifs that form rectangular patterns give a firm impression. Batik is designed with a light blue base color combined with yellow and a little green. The blue color depicts confidence and calmness. The yellow color represents a sense of optimism and enthusiasm. While the green color reflects the fresh impression. It is hoped that after wearing this batik, someone can be more confident, optimistic, and full of enthusiasm in their activities. This batik motif has been produced in collaboration with Zie Natural Batik at the Malonan Gunungpati Natural Batik Center in Semarang, while the production price of this batik is stamped batik per piece of Ro 200,000.00.

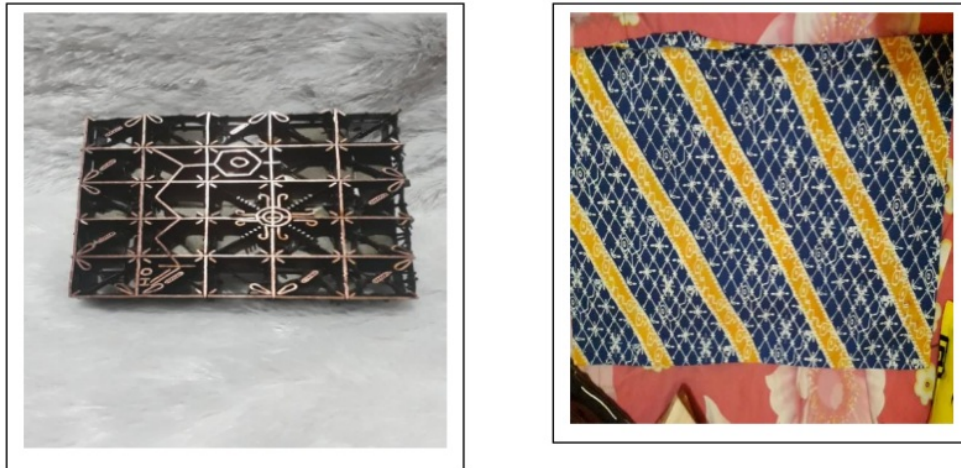


Figure 1. Chemical Striated Batik Products Machete Curcumin Ethno-STEM

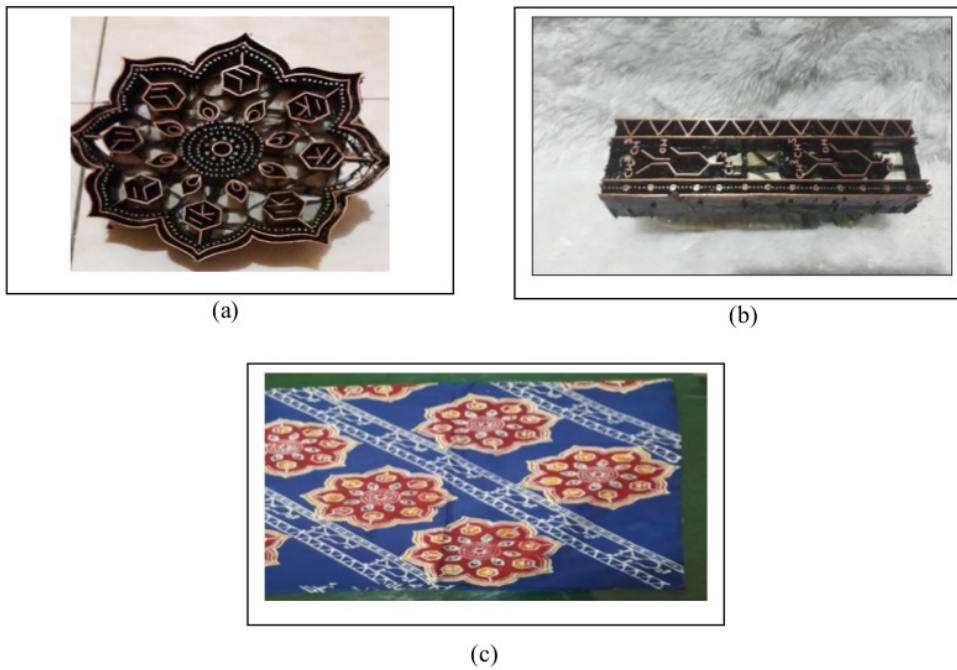


Figure 2. Motif Batik Chemical Parang Alfa Pinena Ethno STEM (a) Alfa Pinena Batik Prints (b) Sitronelal Prints (c) Batik Alfa Pinena Ethno-STEM

3.2. Product Motif Batik Parang Alfa_Pinena Ethno-STEM

The second batik product is the Lurik Chemical Parang Alfa_Pinena Etno-STEM batik (Figure 2). This batik is a parang motif with the main structure of Alfa Pinena and sitronelal compounds with interesting color variations. In this motive the Etno-STEM suffix is given which means that this batik design is actually the work of the nation's children [lecturers, students, and batik] as a form of scientific responsibility and at the same time as a form of downstreaming of Natural Product Organic Chemistry learning research related to secondary metabolites with the approach of Science Technology Engineering and Mathematics (STEM) and Ethnoscience [Ethno-STEM]. The main structure of the compounds contained in this batik are Alfa_Pinena and citronellal compounds which are compounds that contain essential oil groups of turpentine and citronella essential oil types and both of these compounds are groups of terpenoid compounds from monaterpenoids that smell fragrant and give a distinctive aroma and both of the two compounds the. Essential oils are generally isolated by extraction or distillation of fractions from materials containing the terpenoid compounds [16]. Both of these compounds can be used as fragrances, transformed into compounds that are more efficient. This chain of structures that chain and form a modified machete motif expresses the spirit of life. The price of each piece of batik is Rp. 200,000 / piece. Motif Batik Lurik Kimia Parang Alfa_Pinena Etno - STEM

3.3. Parang Alfa Pinena Ethno-STEM Batik Motif Products Prooduct Motif

The purpose of the creation of this Antosiani Ceplok Batik Motif is to preserve the culture of the Indonesian nation for the variety of batik, as well as to introduce it to the public in relation to the pattern and chemical structure of the anthocyanin natural compound (Figure 3). Anthocyanin is a polyphenol-derived compound whose existence is very abundant in nature with diversity in various types of plants and has many important physiological functions in every living organism. Besides being responsible for anthocyanin giving orange to black in higher plants, anthocyanin also acts as a protective against UV-B radiation [16]. This type of batik motif is Ceplok with anthocyanin structure decoration combined with plant leaves, and glass beaker as a symbol of how to isolate these compounds from a plant in a rectangular framed. At this time there are a number of local plants that produce anti-Christian namely mangosteen, red color on tomatoes, and woretel. Ethno-Anthocyanin Batik In addition to the anthocyanin structure, there are also pictures of how to erlenmeyer as a symbol of how to isolate and extract anthocyanin from leaves, flowers, seeds or fruits of certain plants. Chemistry batik typical and ready to be produced at a price of Rp 200,000 / piece as research downstream and ready to be marketed in the coastal area of Semarang City and its surroundings.



Figure 3 Slick Motifs of Batik Chemistry Anthocyanin Ethno STEM




In this research, the creativity and innovative products of the students were very good, so that the downstreaming of the research was continued through the process of producing batik cloth and worth

selling. Downstream research is very important in a study, because it is able to develop entrepreneurial character.

4. Results of Expert Creativity Assessment of Chemical Batik Products

In this study, an assessment of the batik creativity products of the students was also carried out, and some of the inputs from the batik products produced were according to Pekalongan batik experts presented in Table.1.

Table 1. Results of creativity and innovative measurements by Batik experts from Pekalongan

	Knowledge/Assessment Table
 <p data-bbox="365 957 646 982">Batik Karotenoid Ethno-STEM</p>	<p data-bbox="786 625 1331 957">The black color comes from <i>jelawe</i> (<i>Terminalia bellirica</i>) while the indigo is taken from <i>tarum</i> (<i>Indigofera tinctoria</i>). Coloration using natural and chemical colors has some differences. Modifications of the traditional 'lereng' motif, modern elements, and chemical elements are seen on the fabric. However, it is not decorated using 'isen' or ornamental complement motif as it focuses on the chemical elements. There is no embellishments but some stains. However, staining as a result of canting using is a common thing and somehow marks the authenticity of the fabric.</p>
 <p data-bbox="365 1226 646 1251">Batik Kurminid Ethno-STEM</p>	<p data-bbox="786 982 1331 1226">The video shows the abstraction of batik color. There is an element of intent to create a particular artistic value which follows the traditional pattern. The batik consists of two colors: red and yellow. Although comprising only two tones, the fabric does not seem too plain in addition to the clarity of chemical motifs.</p>
 <p data-bbox="365 1541 646 1566">Batik Alfa Pinena Ethno-STEM</p>	<p data-bbox="786 1251 1331 1520">The selection of color and wax should be made carefully as it has to be high-quality ones to avoid overflows and rifts. The color combination is nice with a nuance of coastal and Maduranese motif. Nevertheless, the improvements are needed particularly on the selection of the wax and the clarity of the chemical motifs. A big canting (number 3 or 4) is needed to draw larger chemical structures to enhance the visibility of the motif. This type of batik could be used at schools during chemistry learnings.</p>

The results of the expert's assessment stated that some of the creativity and innovative students had been very good in terms of motifs, authenticity, variations of batik motifs, and contrasting colors' only needed to be developed in the value of art in describing their chemical motifs and structures. In addition to being assessed, experts are also assessed students' critical and innovative thinking skills by the research team. The results obtained are in the form of assessments and or inputs which are then used to improve Batik products going forward, the values of which are presented in creativity and

Innovation based on the N-gan criteria. In this research, it is known that students for motif design and authentic or original achieve high N-gain scores, while for color contrast and creativity in the medium or moderate N-gain category.

5. Conclusion

The results of the analysis of research data and discussion, can be concluded as follows (1) The developed learning model is able to increase students' cognitive knowledge in understanding Natural Product in the context of Ethno-STEM related to materials, batik techniques, and entrepreneurial spirit of Zie batik business owners, (2) able to improve students' creative, innovative and entrepreneurial character based on N-gain scores, (3) produce creativity and innovative chemical batik motifs with structures of secondary metabolites that are worth selling and research downstreaming

6. Reference

- [1] UNNES 2015 *Rencana Induk Pengembangan Universitas Negeri Semarang Tahun 2015 –2034*
- [2] UNNES 2015 *Rencana Strategis 2015- 2019* (Lembaga Peneliti dan Pengabdian Kepada Masyarakat Universitas Negeri Semarang. P2M UNNES)
- [3] National STEM Education Center 2014 *STEM education network manual* (Bangkok: The Institute for the Promotion of Teaching Science and Technology)
- [4] Sudarmin, Woro Sumarni (2019). Model Pembelajaran Kimia Organik Bahan Alam dengan Pendekatan Etnosains Terintegrasi STEM untuk Mengembangkan Karakter Konservasi dan Kewirausahaan Mahasiswa. *Laporan Penelitian* (LP2M UNNES)
- [5] Nancy,(2007). *Model Pembelajaran Kimia Untuk Mengembangkan Sikap Kewirausahaan Siswa. Dissertation* (Bandung: Universitas Pendidikan Indonesia)
- [6] Firman H 2018 *Makalah pada Seminar Nasional Pendidikan Kimia dalam Tantangan Revolusi Industri 4.0.* (FKIP Universitas Kristen Indonesia: Jakarta)
- [7] Brown-Martin G 2017 *Report for Groupe Media TFO* on [https:// www.groupemediatfo.org/wp-content/uploads/ 2017/12/FINAL](https://www.groupemediatfo.org/wp-content/uploads/2017/12/FINAL).
- [8] Sudarmin, Sumarni W 2018 *IOP Conf. Ser.: Mater. Sci. Eng.* The 12th Joint Conference on Chemistry
- [9] Han S, Capraro R & Capraro M M 2014 *Int. J. Sci. Math. Educ.* 1-7.
- [10] Saifudin A 2012 *Senyawa Alam Metabolit Sekunder* (Yogyakarta: CV Budi Utama)
- [11] Abdi and Redha 2010 *J. Belian* **9**(2): 196
- [12] Holbrook J, Laius, A, dan Rannikmäe M 2005 *Pol. J. Environ. Stud.* **14**(4):389
- [13] Reynolds D, Yazdani N & Manzur T 2013 *J. STEM Educ.* **14** (1) 12
- [14] Yusuf, FM and Nurkhasanah 2015 *J. Pharm Sci Res.* **2**(3) 115
- [15] Sudarmin S, Sumarni W, Rr. Sri Endang P, and Susilogati S 2019 *J.Phys.: Conf. Ser.* **1317** 012145
- [16] Sudarmin, Sumami W, Yulianti D, and Zaenuri, 2019 *J. Phys.: Conf. Ser.* **1387** 012085

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